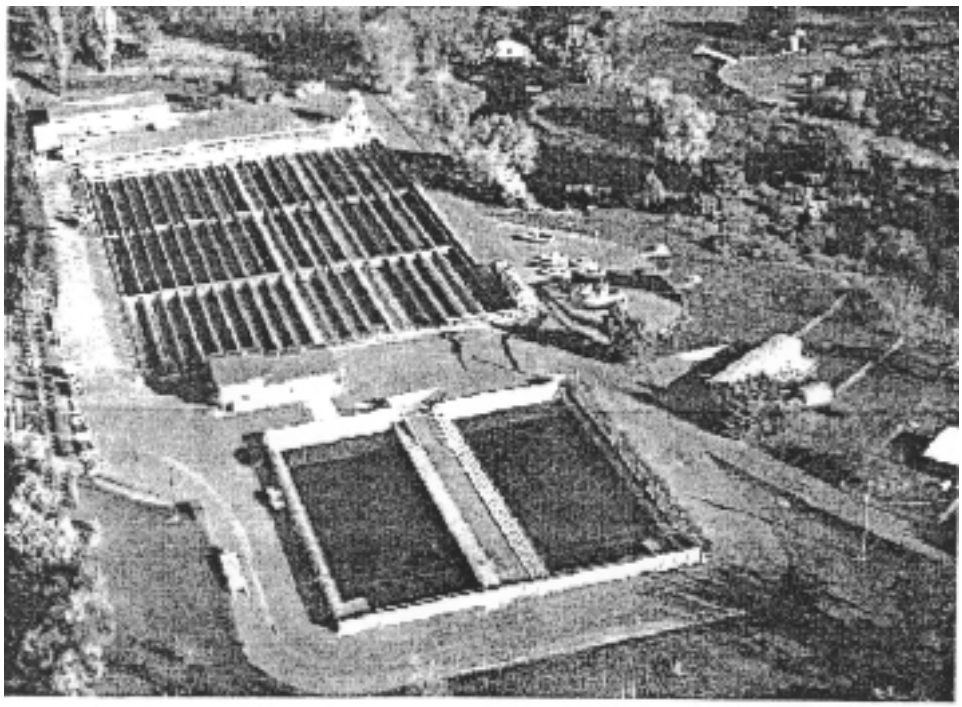
NIAGARA SPRINGS FISH HATCHERY

1999 Steelhead Brood Year Report



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ABSTRACT

Niagara Springs Fish Hatchery (NSFH) received 2,846,546 steelhead, *Oncorhynchus mykiss,* eggs and fry during the 1999 brood year. A total of 1,712,675 eggs were received from Pahsimeroi and Sawtooth hatcheries, while 1,133,871 (533,289 eggs and 600,125 swim-up fry) were received from Oxbow Hatchery.

Total production for the 1999 brood year at NSFH was 2,565,415 steelhead (457,626 lbs at 5.61 fish/lb), which includes both surplus fish and anadromous fish releases. Excess fish were transferred as fry, fingerlings, and smolts.

A total of 269,810 excess steelhead fry (155.60 lbs at 1734.0 fish/lb) were transferred to the Hagerman State Fish Hatchery on June 30, 1999. A total of 364,923 excess steelhead fingerlings (6,600 lbs at 55.29 fish/lb) were released in Lake Walcott on October 21 and 22, 1999. This stocking took place after fin clipping was concluded and final production numbers were determined. Excess spring releases included 126,156 steelhead (31,000 lbs at 4.069 fish/lb), which were stocked into Oakley, Cascade, Arrowrock, Mountain Home, Roseworth and Salmon Falls reservoirs. These stockings took place after all smolt requests were filled.

A total of 1,804,535 steelhead smolts (419,870 lbs at 4.30 fish/lb) were released into the Snake and Salmon rivers from March 27 to May 8, 2000. A total of 830,316 smolts (193,670 lbs at 4.29 fish/lb) of Pahsimeroi stock were released in the Pahsimeroi River at the weir, and 181,317 smolts (42,080 lbs at 4.31 fish/lb) of Pahsimeroi stock were released in the Salmon River at Hammer Creek.

A total of 601,907 smolts (143,220 lbs at 4.20 fish/lb) of Hells Canyon stock were released in the Snake River at Hells Canyon Dam, and 190,995 smolts (40,900 lbs at 4.67 fish/lb) of Hells Canyon stock were stocked in the Little Salmon River at Stinky Springs. No smolts were stocked by NSFH into the Salmon River at Pine Bar Rapids due to a National Marine Fisheries Service (NMFS) decision. Instead, the fish allocated for Pine Bar Rapids were incorporated into the Hammer Creek allocation.

Mortalities from pathogens were below normal this year. All steelhead were vaccinated for furunculosis, *Aeromonas salmonicida,* and enteric redmouth disease, *Yersinia ruckeri*. Furunculosis, ERM, or IHNV were not isolated during the 1999 brood year. Coldwater disease, *Flexibacter psychrophilum*, and *Aeromonas hydrophila* were prevalent primarily late in the year.

A total of 469,043 lbs of fish feed was fed (13,566 lbs of Bioproducts, 15,817 lbs of Moore-Clark, and 439,660 lbs of Rangen) at a cost of $165,912.08 to produce 457,626 lbs of steelhead for a conversion rate of 1.02:1.

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INTRODUCTION

The Niagara Springs Fish Hatchery (NSFH) is owned and financed by Idaho Power Company (IPC), and operated and staffed by the Idaho Department of Fish and Game (Department). It is located in the Snake River Canyon ten miles south of Wendell, Idaho. The NSFH is one of four hatcheries IPC owns and which the Department staffs and operates that fulfill IPCs mitigation requirement under the Federal Energy Regulatory Commission (FERC) license #1971. The goal of NSFH is to rear 400,000 pounds (lbs) of steelhead *Oncorhynchus mykiss* smolts annually. Originally, these smolts were used to relocate a portion of the Snake River steelhead run into the Salmon River. Now, 200,000 lbs of production is used to enhance the steelhead run below Hells Canyon Dam in the Snake River, and 200,000 lbs are stocked in the Salmon River.

OBJECTIVES

The two major mitigation requirements that must be met at IPCs NSFH are to produce quality steelhead smolts to supplement the steelhead trout runs in the Snake River below Hells Canyon Dam and in the Salmon River and its tributaries by successfully meeting these objectives:

1. To rear 200,000 lbs of quality steelhead smolts to be released in the Salmon River and its tributaries. The steelhead are to return as adults in sufficient numbers to provide quality sport fisheries in these waters and to supply sufficient brood stock (1,000 adults) to the Pahsimeroi Fish Hatchery for the collection of spawn for the next production cycle.

2. To rear 200,000 lbs of quality steelhead smolts to be released in the Snake River below Hells Canyon Dam. These are to return as adults in sufficient numbers to provide a quality sport fishery in the Snake River and to supply sufficient brood stock (1,000 adults) to the Hells Canyon Trap for the collection of spawn for the next production cycle.

IDAHO DEPARTMENT OF FISH AND GAME GOALS

1. Provide quality steelhead smolts to the Snake and Salmon rivers that will survive downstream migration and return as adults in sufficient numbers to provide a quality sport fishery in these waters and their tributaries.

2. Provide quality hatchery steelhead for supplementation where wild stocks of steelhead have diminished below desired levels and where managers feel quality hatchery steelhead would enhance the fisheries resource.

3. Enhance the genetic quality of hatchery stocks through management and hatchery practices that favor genetic variability and the wild genetic component.

FACILITY DESCRIPTION

The NSFH facility consists of an indoor nursery area, outdoor rearing raceways, and two flow-through settling ponds. Spring water supplies 21 upwelling incubators and 21 sixty-cubic-foot (cf), rectangular vats for the hatching and early rearing of fry. The incubators and nursery tanks provide 1,260 cf of hatching and early rearing space.

The outdoor rearing space consists of nineteen (300-ft x 10-ft) (142,500 cf) raceways, which are supplied by constant temperature, gravity flow, spring water. This allows for the production of 400,000 lbs of steelhead to a density index of less than the recommended 0.35 lbs/cuft/in. In addition, the odd-numbered raceways are divided in the upper sections into two (4.5-ft x 20-ft) raceways (3,440 cf) for fry and fingerling rearing.

Two flow-through settling ponds (150-ft x 60-ft) have been constructed to remove settable solids from the NSFH effluent. The settling ponds handle all the flow from the raceways and meet Environmental Protection Act (EPA) guidelines for aquaculture discharge. In addition, dissolved nutrients are monitored on a biweekly basis to comply with the terms of a consent order with the Idaho Division of Environmental Quality (DEQ). Samples are collected by Sigma water samplers and sent to Rangen Aquaculture Research Center for analysis.

The NSFH feeding system is completely automated. Two moveable bridges span the rearing area. A total of 19 Nielsen automatic feeders are mounted on the bridges. The fish are fed by moving the bridges down the length of the rearing area and energizing the individual feeders on the control panels. Bulk feed is dispensed to the feeders by a conveyor supplied by two 20,000 lb storage bins with associated fines separator. Ziegler belt feeders feed nursery areas.

Pond cleaning is also automated. An air blower cleaning system has been installed for the raceways. Three blower motors supply approximately 10 psi to the weighted, perforated, airlines on the bottom side corner of each pond. The resulting bubble screen creates a vortex of water currents that keep waste material suspended along the length of the ponds. This system saves many hours of labor sweeping ponds.

Buildings on the NSFH grounds include five residences. Three are wood frame houses, one is a doublewide modular home, and one is a 14-ft wide mobile home. A 32-ft x 80-ft metal building contains an office, two incubator rooms, garage, shop, and feed storage room. Also on the grounds are one storage building (10-ft x 30-ft), a cinder block chiller building (70-ft x 45-ft) contains the chiller and blower-electrical room, a heated shop, and garage. The NSFH is also responsible for the two-acre park across from the springs. It has a public, handicapped-accessible restroom; a picnic table, and refuse containers.

WATER SUPPLY

In addition to NSFH, Niagara Springs supplies water to Rim View Trout Company, Niagara Springs Wildlife Management Area, and Idaho State's Pugmire Park. Niagara Springs total flow is 220 cubic feet per second (cfs), which is divided into water rights by the four users.

The IPC has entered into an agreement with the four other users of Niagara Springs water whereby NSFH will receive water according to a stepped flow chart (Appendix 1). The NSFH has a water right of 132 cfs.

Water temperature is a constant 59°F and flows by gravity to the incubators, nursery vats, outdoor raceways, fire hydrants, and irrigation system. Water quality is checked on a yearly basis at the NSFH (Appendix 2).

STAFFING

Four permanent and two temporary personnel staff the NSFH. Jerry Chapman, Fish Hatchery Manager II, and Michael Graham, Fish Hatchery Assistant Manager handle the NSFH supervision. There are two Fish Culturists, Paul Dorman and Jeffery Seggerman, to handle most operational duties. During peak work activities there are three Bio Aides; Abe Koehler, Gene Waltz and Mike Anderson, who assist the permanent staff with culture, maintenance, and other assignments.

FISH PRODUCTION

Egg Shipments and Early Rearing

The NSFH received both eggs and fry for the 1999 brood year (Appendix 3.). To retard embryonic development, all steelhead eggs and fry were incubated on chilled well water (43°F) prior to transfer to NSFH. This procedure was done to control smolt size while minimizing the need to take fish off feed during the rearing cycle. At the Oxbow Hatchery a 70 horsepower chiller unit was utilized to chill 52°F well water to 43°F for incubation. Pahsimeroi Hatchery does not have a chiller unit for this purpose. Consequently, steelhead eggs are transferred to Sawtooth Hatchery for incubation to eye-up on 41°F wellwater.

A total of 533,289 eyed-eggs from later lots (9-15) were shipped to NSFH from June 1 through June 11, 1999. Early lots (6-8) were transported to NSFH as button-up fry (600,582) between June 29 and July 16, 1999, and placed directly into outdoor nursery raceways. The timing of the fry shipments coincided with the swim-up timing of fish from the eyed-eggs that were received earlier at NSFH. Fry were transported in specially designed, perforated, fry transport tubes. Hagerman State Fish Hatchery furnished the truck used for transportation.

The NSFH received 1,712,675 eyed-eggs of Pahsimeroi stock between May 27 and June 21, 1999 for this brood year (Appendix 3). No fry were sent from the Sawtooth Hatchery during this brood year. Green eggs lots (6-17) from the Pahsimeroi Hatchery were transferred to Sawtooth Fish Hatchery and reared in 41°F wellwater to retard embryonic development before shipping to NSFH.

All eggs were placed in upwelling incubators (42,500 per incubator) inside the vats. Eggs were tempered and disinfected with iodine at 100 ppm for 30 minutes. All fry were tempered in their shipping containers before ponding.

Fry were not inventoried from the nursery vats to the nursery raceways this brood year. Consequently, hatching success and mortality could only be estimated. The NSFH staff observed some above-normal losses in the vats due to suffocation during the early rearing cycle. Survival of fry to fingerling was 92.13% in Pahsimeroi steelhead and 92.75% in Hells Canyon steelhead. Overall fry to fingerling survival was 91.94%. This year the nursery sections were screened at both ends and expanded from 20-ft to 35-ft in length. This prevented fry and fingerlings from getting into the headrace and allowed the fry to be reared at lower starting densities. As densities increased, fry were given more rearing volume (50 ft), then increasing rearing space by utilizing the entire first section (100 ft), where the bridge feeders could be used.

One-half of NSFH fry and fingerling production were fed Bio-Oregon (semi-moist feed) and the other half fed Moore-Clark (extruded dry feed) feeds during the early rearing cycle (Seggerman, 2000). Feed was dispensed with Ziegler belt feeders and supplemented with hand feeding in the outdoor nursery area. When they reached 75 fish/lb, all NSFH steelhead (except indoor feed study fish) were switched to a Rangen extruded diet. The switch to Rangen bulk extruded feed allows NSFH staff to utilize the bulk tanks, feed conveyor system, and bridge feeders.

Final Production Rearing

Fin-clipping operations are used to split the fish into even-numbered and odd-numbered raceway sections. During this program, fish are crowded to the lower 100-ft section. Half the fish are clipped and put into the upper two-thirds of the raceway, while the other half are clipped into the adjacent raceway. Fin-clipping operations started on September 27 and were completed by October 20, 1999.

Fish were given the final 100 ft of rearing space in December. Hells Canyon fish were placed in raceways 1 through 8, while Pahsimeroi fish were placed in raceways 9 through 19. Normal fish culture techniques include: feeding fish with the bridge, sweeping raceways, conducting sample counts, cleaning screens and air lines, removing mortalities, equipment maintenance, record keeping, nutrient sampling, pond scrubbing, supervision and running the ad-marking trailer, length frequency collection and reporting, assisting with CWT and PIT-tagging operations, and conducting tag and mark retention checks.

Hells Canyon steelhead were kept off feed for 48 days to slow growth rates, while Pahsimeroi steelhead were kept off feed for 54 days. Although early growth rates exceeded 0.033 inches per day, growth rates were slowed to 0.021 inches per day by taking the fish off feed for one week at a time. Oxytetracycline was fed allowing for a 21-day withdrawal time prior to stocking to meet Food and Drug Administration requirements.

A combination of Bio-Oregon, Moore-Clark and Rangen fish foods were fed over the course of the year. A total of 15,817 lbs of Moore-Clark, 13,566 lbs of Bio-Oregon, and 439,660 lbs of Rangen were fed for a total of 469,043 lbs (Appendix 5). The Rangen feed total includes 51,693 lbs of OTC medicated feed used for the two medicated feed treatments during this brood year. The total cost of the OTC feed was $24,146.54. The total cost of regular feed was $165,912.08. A total of 457,626 lbs of fish were produced on 469,043 lbs of feed for a conversion rate of 1.02:1. Total NSFH production costs were $778,643.68 (including Idaho Power's expenditures), while the cost/lb of fish produced was $1.70.

Fin quality was assessed in December and April using methods developed by Chapman, (1991). Fins of steelhead reared at NSFH were compared to fins of wild rainbow trout collected from the Henrys Fork. A total of 100 steelhead from four raceways were analyzed for fin degradation. After measuring the lengths of the dorsal and pectoral fins, a fork length is taken from each fish. Comparing the average fin length to the average fork length, fins from fish raised at NSFH were 63% of wild fish fins (Appendix 6). This was a 4% improvement from the 1998 releases and a 9.5% increase from the 1997 releases at NSFH.

Length frequencies (fork length) were taken on a regular basis (December through April) to keep track of variations in fish size and condition factors (Appendix 7). The majority of these lengths are taken for Dean Rhine, Department Hatchery Evaluation Biologist, and those lengths taken just prior to release are for NMFS. A target guideline of 170 to 250 mm was set by NMFS biologists to maximize migration and minimize predation by hatchery steelhead on wild salmon. The average length of the fish at release for four raceways in March and April was 215 mm (8.46 inches).

FEED STUDY

With a NSFH goal of producing high quality steelhead smolts, a feed study was conducted during the 1999 brood year to compare extruded feeds from three large feed producers: Moore-Clark, Bio-Oregon, and Rangen. The goal of the feed study was to determine which feed brand performed better after analyzing different parameters including: Delta L, growth per 30-day month, SGR, condition factor (wt/ln^3), percent survival, fat index, fin factor, observed fish health, conversion rate, cost per lb of fish produced, and cost per 1,000 fish produced. The feed study consisted of an initial trial lasting four months, and a secondary trial lasting an additional five months (Seggerman, 2000).

The initial trial started in June of 1999, and lasted until mid-September. It required approximately 12,000 lbs of each feed brand, and was completed when the fingerlings were 75/fish/lb. The second trial of the feed study started in September 1999, and continued through January 2000. This trial required 60 lbs of feed and involved putting 600 Pahsimerioi stock back into six indoor vats. Study protocol and goals were the same as those in the first trial.

The feed study found that NSFH steelhead fed Moore-Clark grew at a quicker rate and converted better than fish fed Bio-Oregon and Rangen feeds. Fish quality parameters, including fin lengths, percent survival, fat index, and observed fish health, were similar between Bio-Oregon, Moore-Clarke, and Rangen feeds. Production cost parameters, including cost/1000 fish and cost/lb of gain, were best in Rangen feed.

Fish Distribution

IPC contracted with Neil Ring Trucking from Buhl, Idaho, to haul the two IPC tank trailers. Transporting of steelhead from NSFH began on March 27 and finished on May 8, 2000. Eighty-two (82) loads of steelhead (419,870 lbs) were transported to the Snake and Salmon rivers (Appendix 4). The first fish were transported to Hells Canyon, then the Little Salmon

River at Stinky Springs, Pahsimeroi River below the weir, and the Lower Salmon River at Hammer Creek. Biologists felt that Pahsimeroi fish do better if stocked after the second week in April.

Steelhead release figures are as follows: Snake River at Hells Canyon Dam: 601,907 fish (143,220 lbs at 4.20 fish/lb); Little Salmon at Stinky Springs: 190,995 (40,900 lbs at 4.67 fish/lb); Pahsimeroi River below the weir: 830,316 fish (193,670 lbs at 4.29 fish/lb); and the Lower Salmon at Hammer Creek: 181,317 fish (40,080 lbs at 4.31 fish/lb).

Total survival to release was 90.21% for Pahsimeroi steelhead, while total survival to release for Hells Canyon steelhead was 90%. Average survival to release for smolts and excess steelhead was 90.12%. Total NSFH production for the year was 457,626 lbs or 2,565,424 fish.

In addition to steelhead released as part of normal production, a total of 760,889 excess steelhead (37,756 lbs) were transferred or stocked out during the 1999 brood year (Appendix 11). A transfer of 269,810 excess steelhead fry (155.6 lbs at 1,734 fish/lb) to the Hagerman State Fish Hatchery occurred on June 30, 1999. These fry were excess due to a miscalculation at the Oxbow facility and were sent to NSFH in excess of production goals.

A total of 364,923 steelhead fingerling (6,600 lbs at 55.29 fish/lb) were released into Walcott Reservoir on October 21 and 22, 1999. These fingerling were excess after the fin-clipping operations were concluded and final numbers had been placed into all the raceways.

Excess spring releases included 126,156 steelhead (31,000 lbs at 4.07 fish/lb) that were stocked into Oakley, Cascade, Arrowrock, Mountain Home, Roseworth, and Salmon Falls reservoirs (Appendix 11). The stocking of these reservoirs occurred after all smolt requests were filled. Department personnel from the Hagerman State Fish Hatchery transported all NSFH excess steelhead production for this brood year.

FISH HEALTH

Fish health is always a concern at NSFH. The location of NSFH, in the heart of the commercial trout industry, makes it vulnerable to the horizontal transmission of many etiologic agents. Disease problems from Infectious Hematopoietic Necrosis Virus (IHNV), Infectious Hematopoietic Pancreatic Necrosis Virus (IPNV), bacterial furunculosis *Aeromonas salmonicida*, and bacterial coldwater disease (CWD) have caused significant losses in years past (Munson, 1996). In addition, the NSFH and its spring (water source) are located directly below agricultural land, exposing to both toxic drift and runoff from chemical application to fields above the NSFH. Stringent sanitation programs are implemented to facilitate disease control.

Because furunculosis has been a problem in recent years, all of the fish were vaccinated with an autogenous *Aeromonas salmonicida* and *Yersinia ruckerii* bacterins from Aqua Health Limited. These fish were dipped in an oxygenated solution of 8 liters of water to 2 liters of vaccine with a one-percent (1%) salt solution incorporated into the vaccination solution. The salt solution was introduced to the vaccination protocol to reduce stress brought about by physical handling during vaccination and to increase the uptake of vaccine by the fish. Vaccine was applied at a rate of 220 lbs of fish per liter of vaccine, for 30 seconds. The vaccination program started on August 23 and ended on September 13, 1999. All NSFH steelhead were vaccinated and averaged 102.69 fish/lb.

Mortality for the year was well below normal. One raceway had a mixed bacterial infection of *Aeromonas* and *Flavobacterium* just prior to being transferred to the large raceways. Mortalities exceeded 200 fish/raceway/day and IHNV was suspected. *Flavobacterium* and CWD were isolated and a medicated feed treatment of OTC for that raceway was administered. Fish were treated for 10 days with 4% OTC incorporated into the feed in accordance with FDA Investigational New Animal Drug (INAD) #9332 requirements. Two OTC medicated feed treatments were administered to all steelhead at NSFH. The first was given after ad-clipping, when *Aeromonas* and *Flavobacterium* were isolated. The second was prior to release, again, when CWD was isolated. After the medicated feed treatments, mortality returned to normal levels.

The organosomatic index showed normal and above normal values in all categories for both Pahsimeroi and Hells Canyon stocks. Blood work was not taken on both stocks of steelhead at NSFH, so parameters such as serium protein, leukocrit, hematocrit, CTL, and KTL were not assayed for this brood year. The condition of fish from both Hells Canyon and Pahsimeroi stocks at liberation was good.

Furunculosis, IHNV, and ERM were not isolated at this facility during the 1999 brood year. An aggressive disease management program at this facility has been effective in controlling mortality due to these etiological agents. Stress leading to opportunistic bacterial infections may be due to population densities. In the future, management of steelhead inventory at this facility will be the key to managing disease-related mortalities (Munson 2000).

To further improve fish health at NSFH, several impediments to fish culture must be corrected. The nursery rearing should be expanded and improved. A degassing tower should be installed on the existing incubator line to utilize another 400 gpm of water that is currently high in nitrogen gas; or, another water supply line should feed the hatchery building from the lower intake pool.

FISH MARKING

Fin Clipping, CWT, and PIT Tags

All hatchery-reared steelhead in the state are marked with an adipose fin clip. Adipose fin (AD) clipping is done so that the fishermen can differentiate between NSFH and wild steelhead. The clipping process also gives the NSFH staff an accurate inventory, since all fish are counted during clipping. Steelhead were clipped at NSFH between September 27 and October 20, 1999.

Brood year 1999 steelhead were coded-wire tagged (CWT) from September 19 to September 23, 1999. Each tag group is held in an individual section so that separate mortality information can be gathered. The CWT groups of 30,000 fish were given a 100-ft section, while CWT groups of 60,000 fish were given 200 ft of rearing space.

A total of 131,809 CWT fish were released at Hells Canyon Dam, Hammer Creek, Pahsimeroi weir and the Little Salmon River release sites (Appendix 8). A total of 41,249 CWT fish were released in the Snake River at Hells Canyon Dam between March 29 and April 4, 2000, while 35,232 CWT fish were released at the Pahsimeroi weir (Pahsimeroi River) between

April 10 and April 27, 2000. A total of 38,003 CWT fish were released in the lower Salmon at Hammer Creek between April 6 and April 8, and 17,325 CWT fish were released in the Little Salmon at Stinky Springs from April 28 through May 1, 2000.

In addition to the CWT fish, 900 fish were tagged with Passive Integrated Transponders (PIT) tags on February 26, 2000 (raceways 6, 12, and 18). These computer chips are injected into the body cavities of the fish and information can be accessed as to hatchery origin, length, weight, release watershed, date of release, downstream migration, timing, and travel rates. In this manner, an individual fish can be traced on its seaward migration without sacrificing the fish. A total of three mortalities occurred after the tagging was completed.

A total of 900 PIT-tagged fish from the three raceways were tagged for the 1999 brood year at NSFH (Appendix 9). A total of 299 PIT-tagged fish were released at Hells Canyon, while 298 PIT-tagged fish were released in the lower Salmon River at Hammer Creek. In addition, 300 PIT-tagged fish were released at the Pahsimeroi weir (Pahsimeroi River). No PIT-tagged fish were released from NSFH into the Little Salmon River at Stinky Springs to avoid duplications from Magic Valley and Hagerman National Fish Hatcheries stocking there.

SPAWN-TIMING MANIPULATIONS

When hatchery managers are given an egg request by their supervisors, the natural tendency is to start spawning the early-arriving fish and quit spawning when the egg request has been met. Over many generations of spawning early- and middle-run fish, and not spawning late arriving fish, the spawning time could feasibly move forward. Historical records show fish spawning throughout May. Currently, hatchery females are spawned as late as possible, but spawning operations are usually finished by early May.

Current fish feed technology and ingredients allow hatchery managers to raise fish to smolts much faster than in earlier years. In fact, most steelhead smolts reared in southern Idaho are held off feed during the production year so they don't get too large. At times, holding fish off feed for extended periods of time can be detrimental to fish health. Consequently, hatchery managers currently prefer eggs taken from later-spawning females.

In an effort to artificially begin moving the spawn timing back to historical spawning times, hatchery managers have ensured that later eggs will be incorporated into the egg-taking program. If surplus eggs exist, fewer eggs from early- and middle-spawn times will be incorporated into the program. A federal geneticist, Dr. Matt Powell, was contacted to ensure that adequate gametes were taken so the hatchery steelhead program would not be negatively impacted. A guideline of 10% of early-run steelhead and 100% of late run steelhead should be spawned if personnel desire to move the run back without impacting the existing program. Early eggs were not used during this brood year while all of the later eggs were used (Appendix 12). Early and late eggs will be incorporated into the program in the future according to the above guidelines.

RECOMMENDATIONS

Completed Improvements

Several hatchery construction projects were completed this past year. A large three-sided covered shed was constructed to protect screens and equipment from blowing sand and leaves. A small roof was constructed to protect additional screens and equipment behind the feed building. A fish bypass pipe was constructed to keep fish from entering the old settling pond from the new ponds when they are drained. The park barriers across the creek were all replaced with pressure-treated logs. Other projects that were completed included seal-coating all hatchery asphalt and installing a fence around the new house.

Several landscaping projects were also completed this past year. Numerous deciduous trees were planted around the hatchery and the park. River-rock and shrubs were placed around the new house. Numerous sprinkler heads were replaced with larger heads for better lawn coverage. Capital outlay money was used to purchase an extension to the sprinkler system below the house near the river.

A new chlorine pump was purchased for raceway disinfection. Additional upwelling incubators were purchased, along with marbles and stainless steel incubation screens. More hose bibs were installed in the incubator line to accommodate extra incubators. A new laptop computer was purchased by IPC, and the old ice machine from the Pahsimeroi Hatchery was installed in the chiller building.

Needed Improvements

Early Rearing and Incubation

An expansion of the present nursery facility to at least twelve times its present size would adequately accommodate early rearing systems. The number of raceways should be based on optimum density indices needed to rear fish to a larger size (200 fish/lb or 2.5 inches in length) before moving them to outside raceways. Using these criteria, there should be at least 15,120 cf of rearing space to ensure adequate rearing for fry. This system would protect fry from bird predation and provide them with shade from the sun.

Fry from Oxbow and Sawtooth hatcheries are transported back to Niagara Springs in a borrowed 2-ton truck. This practice will probably continue until Pahsimeroi Hatchery obtains a disease-free water source for early incubation of steelhead eggs. Therefore, a 2-ton fish transport truck should be purchased to reduce disease transmission from a borrowed truck. The borrowed truck is thoroughly disinfected prior to use, but disease contamination is still possible by using it.

Final Rearing

At least one more smolt hauling truck and trailer is needed to ensure that smolts are released in a timely manner. Current hauling procedures require up to 45 days to haul fish to their respective release sites. Optimum release timing for smolts to minimize residualism and maximize downstream survival should involve less than half the 45 hauling days we are currently using.

At least six more raceway tail screens need to be built to replace the old screens that are being used for clipping and coded-wire tagging. Additional screens are required so hatchery personnel can move existing screens without losing fish into the settling ponds. Also, additional CWT projects cannot be attempted without more screens if the fish are to be separated from the other fish in the raceway.

The hatchery birdnetting needs to be raised to allow the "modified" pushcart to move across the bridges. Raceway keyways are corroded and do not allow for tail and head screens to seat or be interchanged, so they should be sandblasted.

Employee Safety

A “trash-rack” needs to be installed in front of the intake gate at the upper pool to prevent access to the spring and injury to the public.

Water Source

The water collection box, which supplies water to the incubator rooms, is located near the top of the spring and the amount collected is not enough to safely produce fry. Plans should be developed to tap into the existing pipeline delivering water to the raceways, or the hatchery head pool, as a new supply source. For now, a degassing tower should be installed on the existing hatchery building pipeline because of the possibility of nitrogen gas toxicity. The line will hold 1,600 gpm of water, but only 1,200 gpm is useable because of nitrogen toxicity at 1,250 gpm.

Building Improvements

A new hatchery and incubation building with functional nursery raceways is badly needed. The building should also include public restrooms that are handicap-accessible, an office, shop, meeting room, and an adequate feed storage space.

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APPENDICES

Appendix 1. Niagara Springs Hatchery Monthly Water Allocations

Month	Max. Flow	Month	Max. Flow
May	50 cfs	November	70 cfs
June	50 cfs	December	90 cfs
July	50 cfs	January	100 cfs
August	50 cfs	February	110 cfs
September	50 cfs	March	120 cfs
October	60 cfs	April	120 cfs

Appendix 2. Water Analysis of Niagara Springs Fish Hatchery Source Water

Analysis	Results 94 (mg/l)	Results 97 (mg/l)	Results 98 (mg/l)	Results 99 (mg/l)	Results 00 (mg/l)	Maximum Contamination Level
Alkalinity	166	195	160	140	170	10.0
Antimony	0.002	N/T*	N/T*	NT*	ND*	0.006
Arsenic	0.005	N/D*	N/D*	ND*	ND*	0.05
Barium	0.180	N/D*	N/D*	ND*	ND*	1.000
Beryllium	0.0002	N/T*	N/T*	NT*	NT*	0.004
Cadmium	0.00034	N/D*	N/D*	ND*	ND*	0.004
Chromium	0.002	N/D*	N/D*	ND*	ND*	0.1
Chloride	N/T	46	48	47	46	250
Copper	0.010	N/D*	N/D*	ND*	ND*	1.3
Cyanide	0.005	N/T*	N/T*	NT*	NT*	0.200
Fluoride	0.570	N/D*	N/D*	0.5	0.6	4.0
Hardness	234	270	230	230	230	100
Iron	0.010	N/D*	N/D*	ND*	ND*	0.3
Lead	0.002	N/D*	N/D*	ND*	ND*	0.015
Manganese	N/T	N/D*	N/D*	ND*	ND*	0.05
Mercury	0.0002	N/D*	N/D*	ND*	ND*	0.002
Nickel	0.003	N/D*	N/D*	ND*	ND*	0.1
Nitrate as N	1.630	1.9	1.9	1.8	1.6	10
Nitrite as N	0.01	N/D*	N/D*	ND*	ND*	1.0
PH	8.00	8.1	8.3	8.2	8.4	6.5 - 8.5
Selenium	0.005	N/D*	N/D*	ND*	ND*	0.05

*N/D = Not detected
*N/T = Not tested

Appendix 3. Niagara Springs Steelhead Survival from Egg to Smolt

Source	Eggs Received	Fry Received	Total Received	Fry and Fingerlings Released	% Survival Fingerlings	Smolts Released	Total Release	% Survival to Release
Pahsimeroi	*1,712,675	0	*1,712,675	*439,201	92.13%	1,011,633	@1,544,980	90.21%
Oxbow	533,289	600,582	1,133,871	195,523	91.75%	792,902	@1,020,435	90.00%
Totals	***2,245,964**	**600,582**	***2,846,546**	***634,724**	**91.94%**	**1,804,535**	**@2,565,415**	**90.12%**

*Reflects an additional 282,000 eggs which were sent to Hagerman State F.H. as 269,810 fry.
@ Reflects an excess of 760,889 smolts of HC and Pah. stock , planted as resident fish (appendix11)

Appendix 4. Niagara Springs Steelhead Distribution

Destination		Stock	Weight	Dates	Number Per Pound	Number Released
Hells Canyon	(Snake R.)	H.C.	143,220	3/27-4/9/00	4.20	601,907
Stinky Springs	(Little Salmon R.)	H.C.	40,900	4/10-4/13/00	4.67	190,995
Pahsimeroi	(Pahsimeroi R.)	Pah.	193,670	4/14-5/4/00	4.29	830,316
Hammer Creek	(Salmon R.)	Pah.	42,080	5/5-5/8/00	4.31	181,317
Total			**419,817**		**4.30**	**1,804,535**

Appendix 5. Niagara Springs Hatchery Production Costs

Number of Fish	Lbs of Feed	Cost of Feed	Pounds of Fish	Feed Conversion	Total Cost	Cost per 1,000	Cost per Pound
2,565,415	469,043	$165,912.08	457,626	1.02	*$778,643.68	*$303.52	*$1.70

*Cost includes IPC cost for overhead, smolt hauling and shop expenditures

Appendix 6. Fin Lengths of Niagara Springs Fish Hatchery Steelhead, April 1999

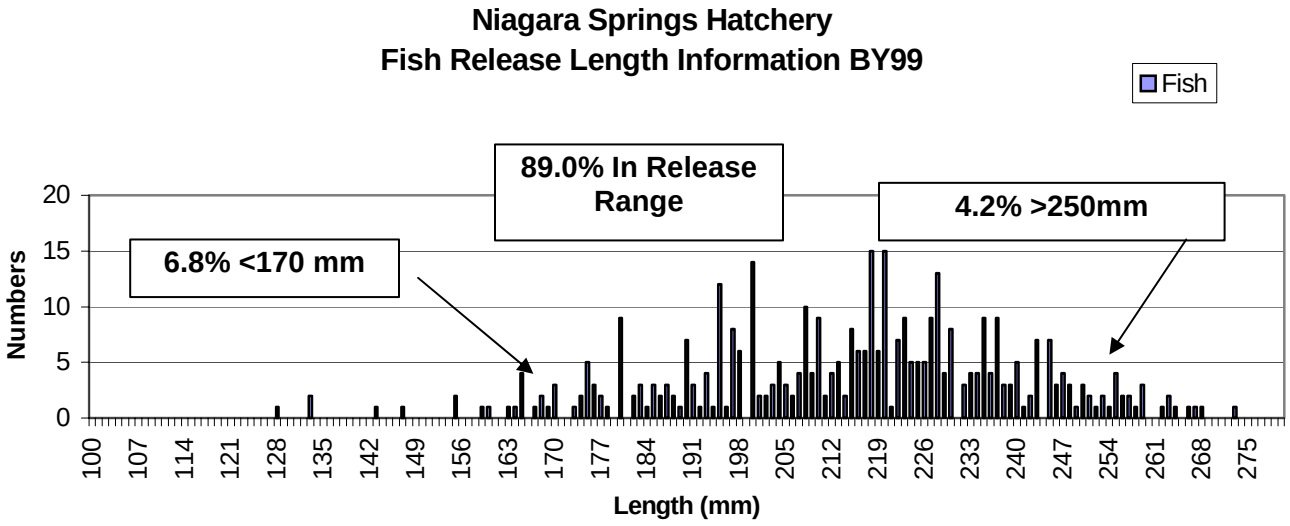
Average of 100 fish groups

Raceway	Fork Length	Right Pectoral	Left Pectoral	Dorsal	Ave. Fin Length	Fin Factor
6	211	22	21	13	19	67
8	214	21	21	14	19	69
12	213	18	14	11	14	52
18	222	23	21	11	18	63
Average	**215**	**21**	**19**	**12**	**18**	**63**

Appendix 7. Length Frequencies (Fork) at Release for Four Raceways, April 2000

Raceway #	H.C. 6	H.C. 8	Pah 12	Pah 18
Sample Size	100	100	100	100
Ave. Length	211	214	213	222
Lower Range (mm)	137	134	138	147
Upper Range (mm)	252	258	246	268

	(mm)	(inches)
Hells Canyon Average Length	212.5	8.37
Pahsimeroi Average Length	217.5	8.56
Overall Average Length	**215.0**	**8.46**



Appendix 8. The CWT Summary for Steelhead at Niagara Springs Fish Hatchery

Raceway	Release Site	CWT Number	Number Tag	Mortality to Release	Number Shed	CWT Number Released	CWT Number Untagged	Total Tagged Group Release	Total Site Release
	Snake River								
4	Hells Canyon Dam	10-54-25	32,343	568	1,589	30,186	66,204		
Total-4			**32,343**	**568**	**1,589**	**30,186**	**66,204**	**96,390**	
	Snake River								
6	Hells Canyon Dam	10-54-24	32,734	121	453	32,160	69,995		
Total-6			**32,734**	**121**	**453**	**32,160**	**69,995**	**102,155**	**601,907**
	L. Salmon R								
8	Stinky Springs	10-55-13	21,904	118	871	20,915	15,672		
8	Stinky Springs	10-55-14	22,905	122	911	21,872	15,825		
8	Stinky Springs	10-55-15	21,783	116	867	20,800	15,672		
Total-8			**66,592**	**356**	**2,649**	**63,587**	**47,169**	**110,756**	**190,995**
	Pah. River								
12	Pahsimeroi Trap	10-46-50	11,580	110	780	10,690	22,501		
12	Pahsimeroi Trap	10-55-12	22,900	212	1,543	21,145	43,285		
Total-12			**34,480**	**322**	**2,323**	**31,835**	**65,786**	**97,621**	
	Pah. River								
16	Pahsimeroi Trap	10-46-49	12,426	93	821	11,512	20,779		
16	Pahsimeroi Trap	10-55-11	22,304	165	1,475	20,664	40,376		
Total-16			**34,730**	**258**	**2,296**	**32,176**	**61,155**	**93,331**	**830,316**
	Salmon R.								
18	Hammer Creek	10-55-28	22,868	216	2,084	20,568	12,121		
18	Hammer Creek	10-55-29	22,586	213	2,058	20,315	11,894		
18	Hammer Creek	10-55-30	21,962	207	2,002	19,753	11,494		
Total-18			**67,416**	**636**	**6,144**	**60,636**	**35,509**	**96,145**	**181,317**

Total CWT Release	**249,345**
Total Site Releases	**1,804,535**
Total Smolt Releases	**1,804,535**
Total Hatchery Releases	***2,565,415**

*denotes all fish released from fry transfers, fall and spring stockings of excess steelhead smolts

Appendix 9. Pit Tag Summary for Steelhead at Niagara Springs Hatchery

Raceway	Release Site	Number Tagged	Number Released	Mortality
6	Hells Canyon Dam Snake River	300	299	1
12	Hammer Creek Salmon River	300	298	2
18	Pahsimeroi Weir Pahsimeroi River	300	300	0
Totals		**900**	**897**	**3**

Appendix 10. Niagara Springs Hatchery History, BY66 to Present.

NIAGARA SPRINGS HATCHERY
HATCHERY HISTORY BY66-PRESENT

YEAR	PAHSIM. Eggs/fry Received	OXBOW Eggs/fry Received	TOTAL Eggs/fry Received	TOTAL Yearly MORT.	% MORT Yearly	FALL Releases	Salmon R. SMOLT Release	Hells C. SMOLT Release	SPRING Releases	TOTAL LBS Released	Feed fed Total	Conv.	Fish/lb
1965-66	0	3,085,194	3,085,194	---	---	---	---	---	---	---	---	---	---
1966-67	0	2,605,288	2,605,288	623,533	23.93	29,400	1,364,842	587,513	1,952,355	153,552	305,890	1.99	12.71
1967-68	0	3,215,652	3,215,652	1,209,183	37.60	0	1,664,325	342,144	2,006,469	204,251	298,450	1.46	9.82
1968-69	0	2,469,536	2,469,536	695,219	28.15	0	1,665,117	109,200	1,774,317	184,186	280,430	1.52	9.63
1969-70	1,477,695	1,927,727	3,405,422	654,022	19.21	757,500	1,608,000	385,900	1,993,900	299,235	502,410	1.68	6.66
1970-71	1,330,494	1,480,150	2,810,644	-305,176	-10.86	670,960	1,630,002	0	2,444,860	202,025	384,040	1.90	12.10
1971-72	1,439,842	700,061	2,139,903	153,603	7.18	215,625	1,555,050	0	1,770,675	235,375	376,080	1.60	7.52
1972-73	8,850,764	1,819,721	10,670,485	3,105,637	29.10	3,008,664	1,543,349	0	4,556,184	163,839	266,800	1.63	27.81
1973-74	3,663,990	1,264,384	4,928,374	2,953,847	59.94	0	1,960,378	0	1,974,527	187,494	319,130	1.70	10.53
1974-75	3,160,144	280,098	3,440,242	2,108,426	61.29	0	1,331,280	0	1,331,816	166,640	352,890	2.12	7.99
1975-76	2,234,978	51,559	2,286,537	513,688	22.47	40,977	1,690,390	0	1,731,872	248,708	437,600	1.76	6.96
1976-77	2,487,824	730,862	3,218,686	1,642,383	51.03	0	1,433,675	141,005	1,576,303	251,835	454,762	1.81	6.26
1977-78	2,540,728	517,250	3,057,978	1,229,537	40.21	281,208	1,266,025	0	1,547,233	154,829	370,080	2.39	9.99
1978-79	2,048,350	441,069	2,489,419	426,977	17.15	344,944	1,372,454	0	1,717,498	244,887	643,680	2.63	7.01
1979-80	2,622,425	124,814	2,747,239	203,985	7.43	548,987	1,097,060	348,220	1,994,267	314,100	629,580	2.00	6.35
1980-81	1,697,010	498,416	2,195,426	720,172	32.80	0	862,494	612,760	1,475,254	316,330	622,930	1.97	4.66
1981-82	2,003,418	298,952	2,302,370	953,015	41.39	0	995,205	354,150	1,349,355	374,350	663,850	1.77	3.60
1982-83	2,313,339	253,776	2,567,115	1,431,975	55.78	500,000	542,390	92,750	635,140	181,150	448,860	2.48	3.51
1983-84	2,749,292	709,716	3,459,008	1,849,313	53.46	449,070	752,195	408,430	1,160,625	310,000	632,400	2.04	3.74
1984-85	2,333,760	598,404	2,932,164	613,771	20.93	630,500	1,273,181	414,712	1,687,893	314,650	541,198	1.72	5.36
1985-86	1,332,152	1,582,340	2,914,492	903,999	31.02	330,640	860,358	819,495	1,679,853	339,885	580,850	1.71	4.94
1986-87	1,339,176	935,195	2,274,371	422,476	18.58	39,995	1,011,900	800,000	1,811,900	419,000	557,960	1.33	4.32
1987-88	1,640,040	1,289,029	2,929,069	775,569	26.48	404,000	872,100	877,400	1,749,500	405,515	584,290	1.44	4.31
1988-89	1,256,289	1,213,399	2,469,688	803,488	32.53	0	930,700	735,500	1,666,200	406,800	574,770	1.41	4.10
1989-90	1,925,795	833,397	2,759,192	252,892	9.17	603,000	956,100	947,200	1,903,300	465,400	597,310	1.25	4.09
1990-91	1,966,434	113,190	2,079,624	311,624	14.98	0	856,000	912,000	1,768,000	484,025	632,030	1.28	3.65
1991-92	650,400	691,500	1,341,900	311,400	23.21	0	786,600	243,900	1,030,500	232,500	283,000	1.22	4.43
		812,000	812,00	394,936	48.64	0		417,064	417,064	72,786			5.73
	Wallowa												
1992-93	1,131,951	1,013,846	2,145,797				761,800	353,600		235,075			
1992-93	Babington		*Babington	Release	In Little	Salmon	*222,560	306,907	**47,089	131,090			
			**Brownlee	Reservoir									
1993-94	954,294	1,509,596	2,463,890	1,263,820	54.89	0	928,981	609,115	1,538,096	350,151	440,143	1.26	4.40
1994-95	1,042,728	1,099,915	2,142,643	281,034	13	160,000	741,180	960,429	1,701,609	376,060	489,960	1.29	4.52
1995-96	1,400,000	1,397,103	2,797,103	906,008	32.4	157,600	890,135	843,360	1,733,495	352,750	429,528	1.22	5.00
1996-97	1,297,250	1,303,599	2,600,849	698,156	26.84	149,040	1,093,002	660,651	1,753,653	370,520	421,144	1.14	4.79
1997-98	1,434,497	1,211,977	2,646,474	992,649	37.5	0	942,430	711,395	1,653,825	361,745	412,624	1.14	4.57
1998-99	1,412,000	1,393,383	2,805,383	759,809	27.08	60,634	1,185,535	657,665	1,843,200	444,455	484,110	1.09	4.63
1999-00	1,712,675	1,133,871	2,846,546	281,131	9.87	364,914	1,011,633	792,902	2,295,605	457,626	469,043	1.02	4.30

Appendix 11. Transferred or Stocked Broodyear 1999 Steelhead from NSFH

Date	Treatment (Stock/Transfer)	Location	Stock (HC or Pah.)	Size (fpp)	Number (lbs)	Number (#)
6/30/99	Transferred	Hagerman F.H.	HC	1734.00	155.60	269,810
10/21/99	Stocked	Lake Walcott	Pah.	36.80	4,600.00	169,400
10/22/99	Stocked	Lake Walcott	HC	96.80	2,000.00	195,523
5/12/00	Stocked	Oakley Res.	Pah.	4.42	3,000.00	13,260
5/15/00	Stocked	Cascade Res.	Pah.	4.42	7,000.00	30,940
5/16/00	Stocked	Cascade Res.	Pah.	4.42	7,000.00	30,940
5/17/00	Stocked	Arrowrock Res.	Pah.	4.42	3,000.00	13,260
5/17/00	Stocked	Mtn. Home Res.	Pah.	4.42	1,300.00	5,746
5/17/00	Stocked	Mtn. Home Res.	HC	3.30	2,700.00	8,910
5/18/00	Stocked	Roseworth Res.	HC	3.30	3,000.00	9,900
5/18/00	Stocked	Salmon Falls Res.	HC	3.30	4,000.00	13,200
		Total:			**37,756.00**	**760,889**

Appendix 12. Oxbow and Pahsimeroi Stock Run-Timing Manipulations at NSFH for BY 1999

Oxbow Stock Returned Back to Hells Canyon			**Pahsimeroi Stock Returned to Pahsimeroi Weir**		
Lot Number	Spawn Taking Date	Percentage Returned	Lot Number	Spawn Taking Date	Percentage Returned
A	03/15/99	0%	1	03/15/99	0%
B	03/18/99	0%	2	03/18/99	0%
C	03/22/99	0%	3	03/22/99	0%
D	03/25/99	0%	4	03/26/99	0%
E	03/29/99	99%	5	03/29/99	0%
F	04/01/99	95%	6	04/01/99	0%
G	04/05/99	0%	7	04/05/99	100%
H	04/08/99	0%	8	04/08/99	100%
I	04/12/99	100%	9	04/12/99	100%
J	04/15/99	100%	10	04/15/99	100%
K	04/19/99	100%	11	04/16/99	60%
L	04/22/99	100%	12	04/19/99	60%
M	04/26/99	100%	13	04/22/99	60%
N	04/29/99	100%	14	04/26/99	60%
O	05/07/99	100%	15	04/29/99	100%
			16	05/03/99	100%
			17	05/06/99	100%

Submitted by:

Jerry Chapman
Fish Hatchery Manager II

R. Paul Dorman
Fish Culturist

Approved by:

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Virgil K. Moore, Chief
Fisheries Bureau

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Tom Rogers
Fish Hatcheries Supervisor